European Patent Office (11) Disclosure number: **0 374 088**

A1

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: **89810755.2**

(51) Int. Cl[8]: **A61B 17/58, A61F 2/00**

(22) Date of application: **04 October 1989**

(36) Priority: **16 December 1988 CH 4654/88**

(43) Date of disclosure of application:
20 June 1990 *Patentblatt* 90/25

(84) Contracting states named:
AT DE FR GB IT

(71) Applicant: **Gebrueder Sulzer Aktiengesellschaft**
Zuercherstrasse 9
CH-8401 Winterthur (CH)

Applicant: **Protek AG**
Stadtbachstrasse 54
CH-8001 Bern (CH)

(72) Inventor: **Mueller, Prof. Maurice E., M.D.**
Melchenbuehlweg 9

CH-3006 Bern (CH)

Inventor: **Spotorno, Dr. Lorenzo, M.D.**
Ospedale Riunitit
I-17024 Finale Ligure (IT)

Inventor: **Frey, Dr. Otto**
Wallruetistrasse 55
CH-8400 Winterthur (CH)

[illegible number] **Bone Screw**

(57) The single-threaded or multi-threaded bone screw is designed as a corkscrew; that is, its threadings (4) are not positioned on a solid core but "wind around" a cylindrical hollow (5).

The new shape of the threading (4) permits a wide-ranging adaptation of the bending flexibility of the screw to the bending elasticity of the bone.

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Bone Screw

The invention concerns a bone screw for fixing implants in cancellous bone tissue.

Bone screws for fixing implants have existed for a long time. Previously they were designed in such manner that a single-thread or multi-thread threading, as in a woodscrew, was carried by a solid core. Particularly for bending stresses, in relation to the tissue surrounding them these bone screws are an inflexible foreign body that creates resistance to the flexible distortion of the bone and thereby affects the elasticity of the bone.

It is therefore the task of the invention to create a bone screw whose elasticity is better adapted to that of the bone tissue than is the case with the existing constructions. The invention achieves this by means of a threading component designed as a hollow corkscrew cylinder that is positioned on a screw head.

When the new screw is screwed in, there is inside its hollow cylinder a "core" of living bone tissue that after a short time coalesces with the tissue and can thereby be kept viable.

Since this bone core, which essentially determines the elasticity of the screw against bending, has the flexibility of the bone, the elasticity of the screw likewise more or less approximates that of the "undisturbed" bone, particularly in dealing with bending stresses.

To ensure good "hold" of the bone core in the hollow cylinder of the screw, it is advantageous if the pitch of the threading is at least equal to the cross-section measurement parallel to the screw axis.

Practically no radial forces are created by the screw if the cross-section of the threadings running through the casing of the hollow cylinder is rectangular or square. It has proven advantageous for the firmness and stability of the threading if the cross-section measurement perpendicular to the screw axis is at most double that of the cross-section measurement parallel thereto.

When relatively limited radial forces are accepted, the screwing of the screw into the bone can be made easier if the cross-section of the threadings running through the casing of the hollow cylinder is composed of a rectangular or square and a triangle or sector of a circle or semi-circle, with the triangle, semi-circle, or sector of a circle facing outward.

Lastly, it is also possible to design the screw with double-threading or multi-threading, to improve the guiding function when the screw is screwed in and to reduce the number of turns required for the complete screwing in of the screw.

The invention is explained in greater detail below in conjunction with the drawing by means of embodiments.

Fig. 1 is a view of the new bone screw, the threadings of which are shown partly in cross-section;

Figs. 2 and 3 are views of Fig. 1 from below and from above, respectively;

Figs. 4, 5, and 6 reflect various cross-sections for the threading, while

Fig. 7 shows, in the same representation as Fig. 1, a second embodiment that is double-threaded.

A screw head 1 (Fig. 1) equipped with a hexagon socket 2 (Fig. 3) for the insertion of an instrument is positioned on a very short solid neck 3. Attached to this neck in Fig. 1 is a single thread 4, which as corkscrew casing 6 of a hollow cylinder surrounds a hollow area 5 (Fig. 2). In Fig. 1 the cross-section of the single threading 4 is rectangular, with the external corners being rounded.

The pitch b of threading 4 is equal to or larger than twice the cross-sectional measurements 2.a in the direction of the screw axis 7.

At its free end 8, the threading 4 is flattened like a tongue, to facilitate screwing into the bone.

As already mentioned, rectangular or square cross-sections of threading 4 are preferred, since they exert practically no radial forces on the bone. An appropriate rectangular cross-section is shown in Fig. 2. To prevent point stresses in the bone, the corners of the cross-section are rounded. To give the threading adequate stability, the ratio of rectangle measurements c perpendicular to the rectangle measurements of a parallel to screw axis 7 should not exceed 2:1. In the embodiment shown, this ratio of c to a is [illegible symbol] 1.35.

In Fig. 5, the cross-section of threading a is composed of a rectangle and a triangle. A shape of this type exerts radial pressures on the bone, but these pressures are accepted for the sake of the advantage that the screw is easier to screw in, compared to a square or

rectangular cross-section; since the triangle is isosceles, recurrent moments occur, for example during the screwing-in process.

In its effect with respect to radial forces and easier screwing, the cross-section according to Fig. 6 is composed advantageously of a rectangle and a semi-circle, advantageously a semi-circle, between the forms according to Figs. 4 and 5. The stability condition explained in connection with Fig. 4 is also maintained in the cross-section forms according to Figs. 5 and 6.

The bone screw according to Fig. 7 differs from the bone screw according to Fig. 1 in that the threading 4 is a double threading; both threadings of the screw according to Fig. 7 have a square cross-section. Such a double threaded screw offers the advantage that the screw centers itself while it is being screwed in, and it needs only half the number of turns in order to be properly inserted.

Claims

1. Bone screw for fixing implants in cancellous bone tissue, characterized by the fact that the threading (4) attached to a screw head (1) is designed as a hollow cylinder similar to a corkscrew.

2. Bone screw according to claim 1, characterized by the fact that the cross-section of the threading (4) running through the casing (6) of the hollow cylinder is rectangular or square.

3. Bone screw according to claim 1 or 2, characterized by the fact that the cross-section of the threading (4) running through the casing (6) of the hollow cylinder is composed of a rectangle or a square and a triangle, with the triangle facing outward.

4. Bone screw according to one of claims 1 to 3, characterized by the fact that the cross-section of the threading (4) running through the casing (6) of the hollow cylinder is composed of a rectangle or a square and a sector of a circle or a semi-circle, with the sector or the semi-circle facing outward.

5. Bone screw according to one of claims 2 to 4, characterized by the fact that the cross-section measurement (c) perpendicular to the screw axis (7) is at most double the cross-section measurement (a) parallel thereto.

6. Bone screw according to one of claims 1 to 5, characterized by the fact that the pitch (b) of the threading (4) is at least equal to twice the cross-section measurement (2.a) parallel to the screw axis (7).

7. Bone screw according to one of claims 1 to 6, characterized by the fact that the threading (4) is at least double.

European Patent Office **EUROPEAN SEARCH REPORT**

Application No.
EP 89810755.2

PERTINENT DOCUMENTS

Category	Identification of document; if necessary, indicate pertinent sections	Relates to claim	CLASSIFICATION OF APPLICATION (Intl. Class.)
A	EP – A2 – 0 172 130 (ME CRON) * Claim 1; fig. 1 *	1	A 61 B 17/58 A 61 F 2/00
A	DE – A1 – 3 538 238 (FISCHER) * Claims 1-3; fig. 1 *	1	

FIELDS RESEARCHED
(Int. Cl.)

A 61 B
A 61 F

The foregoing search report was issued for all patent claims.

Place of search	Completion of search	Examiner
VIENNA	28 March 1990	MIHATSEK

CATEGORIES OF DOCUMENTS INDICATED

A: Technological background

[Other categories not pertinent]